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**United States Patent** [19]**Handlin, Jr. et al.**[11] **Patent Number:** **5,405,911**[45] **Date of Patent:** **Apr. 11, 1995****[54] BUTADIENE POLYMERS HAVING  
TERMINAL FUNCTIONAL GROUPS**

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[52] **U.S. Cl.** ..... 525/139; 525/170;

525/171; 525/182; 525/183; 525/184;

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525/378; 525/379; 525/383; 525/384; 525/386

[58] **Field of Search** ..... 525/139, 170, 171, 182,

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[56] **References Cited**

**U.S. PATENT DOCUMENTS**

- Re. 27,145 6/1971 Jones .  
 2,693,461 11/1954 Jones et al. .  
 2,864,809 11/1958 Jones et al. .  
 3,415,898 12/1968 Walker .  
 3,629,172 12/1971 Jones .  
 3,770,698 11/1973 Riew .  
 3,935,343 1/1976 Lim .  
 3,994,868 11/1976 Inomata et al. .  
 4,020,125 4/1977 Suzuki et al. .  
 4,028,485 6/1977 Poloso et al. .  
 4,039,593 8/1977 Kamienski et al. .  
 4,075,289 2/1978 Falk .  
 4,469,829 9/1984 Konietzny et al. .... 525/333.2  
 4,496,613 1/1985 Zagefka et al. .... 525/332.8  
 4,507,430 3/1985 Shimada et al. .  
 4,595,749 6/1986 Hoxmeier .  
 4,730,031 3/1988 Sato et al. .  
 4,855,509 8/1989 Dave et al. .  
 4,857,615 8/1989 Bronn et al. .  
 4,857,618 8/1989 Silver et al. .  
 4,866,120 9/1989 Rudnick et al. .  
 4,906,691 3/1990 Joseph et al. .  
 4,994,526 2/1991 Peters .

4,994,532 2/1991 Hawkins et al. .

**FOREIGN PATENT DOCUMENTS**

- 793660-Q 5/1973 Belgium .  
 0209956 7/1986 European Pat. Off. .  
 147247 3/1981 German Dem. Rep. .  
 208470A 5/1984 German Dem. Rep. .  
 208471A 5/1984 German Dem. Rep. .  
 234682A 4/1986 German Dem. Rep. .  
 234683A 4/1986 German Dem. Rep. .  
 3342766A 5/1984 Germany .  
 59-053515A 3/1984 Japan .  
 59-053516A 3/1984 Japan .  
 60-052845A 3/1985 Japan .  
 63-268703A 11/1988 Japan .  
 64-43503 2/1989 Japan .  
 1373045 11/1974 United Kingdom .  
 1520489 8/1978 United Kingdom .  
 WO91/12277 8/1991 WIPO .

**OTHER PUBLICATIONS**

P. Lutz, E. Franta & P. Rempp, "An Efficient Bifunctional Lithium-Organic Initiator To Be Used in Apolar Solvents", 1982, pp. 1953-1959.

F. Bandermann, H. Speikamp & L. Weigel, "Bifunctional Anionic Initiators", Makromol. Chem., 2017-2024 (1985).

G. Bienert et al., "A Bifunctional Anionic Initiator Soluble in Polar Solvents", Makromol. Chem. 179, 551-555 (1978).

T.-P. Liao & J. P. Kennedy, "New Telechelic Polymers and Sequential Copolymers by Polyfunctional Initiator-Transfer Agents", Inst. of Poly. Sci., U. of Akron, Akron, Ohio, pp. 233-240.

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[57] **ABSTRACT**

Hydrogenated butadiene polymers having terminal functional groups have minimum viscosity at any molecular weight when the 1,2-addition is between 30% and 70%. Hydrogenated butadiene polymers having about two terminal hydroxyl groups per molecule have surprisingly lower viscosities at 30% to 70% 1,2-addition than similar polymers having either higher or lower amounts of 1,2-addition. The polymers are useful in making coatings, sealants, binders, and block copolymers with polyesters, polyamides, and polycarbonates.

**12 Claims, 1 Drawing Sheet**